

pointing device in order to establish which queue in the first set should receive that event.

An enhancement used in preferred embodiments of the present invention involves the use of logical events rather than actual events. With this approach, the events stored by the routing means in the first and second sets of queues are logical events rather than the actual events entered via the specific input devices. The incorporation in the preferred embodiment of logical events allows devices to be changed without specific changes to applications. Any new device is classified as either 'keyboard-like' or 'pointer-like' and the events handled accordingly.

From the above, it is apparent that the present invention uses a hybrid queue to handle user events in a GUI system. The problems of system lockup, extra user effort, and the inability to provide a 'type ahead' facility, are avoided. Input devices are divided into two categories: keyboard-like (or non-pointing) devices where the input contains no positional information; and pointing devices, such as a mouse or stylus, that have positional information attached to each event. For input from pointing devices, a queue is built for each window on the system. For input from keyboard-like devices, the system according to the invention simulates a single queue for each type of keyboard-like device, these queues being transferable between the various windows of the GUI system. This approach provides a system with type ahead capabilities, whilst the presence of multiple queues prevents lock up by a badly written application.

The present invention will be described further, by way of example only, with reference to a preferred embodiment thereof as illustrated in the accompanying drawings, in which:

FIG. 1 illustrates how events are handled in a synchronous event handling system according to the prior art;

FIG. 2 illustrates how events are handled in an asynchronous event handling system according to the prior art;

FIG. 3 illustrates how events are handled in a system according to the preferred embodiment of the present invention;

FIG. 4 is a block diagram illustrating a system according to the preferred embodiment of the present invention;

FIGS. 5A and 5B are flow diagrams illustrating how events are received and handled by the dispatcher of the system according to the preferred embodiment; and

FIG. 6 is a flow diagram illustrating how an application processes events stored on the various queues by the system of the preferred embodiment.

Before discussing the preferred embodiment of the present invention in detail, the following overview of a system according to the preferred embodiment will be given. In the following description a 'keyboard-like' device may be considered to be one that sends a stream of character input to the system. As well as actual keyboards other devices may behave like keyboards. For example, a speech recognition device may turn spoken words into sequences of keystrokes.

In the system of the preferred embodiment, a queue is initially assigned to each keyboard-like device connected to the system. For each keyboard-like device, the associated queue handles keystrokes in a FIFO manner. The output from each of these queues will be directed to one particular window at any specified moment in time, but such queues are transferable between the various windows. As with many current systems the window which is receiving input is said to have "focus". Hence, for example, at any moment in time only one window will have keyboard focus and so be able to receive typed input from the keyboard. At the same moment in time another window may have speech focus and so be able to receive spoken input.

In the preferred embodiment, to provide for events from pointing devices that, in contrast to keyboard-like devices, include positional information, a single FIFO queue is provided for each window on the system. The events from each pointing device (eg. a mouse, a stylus, etc) are directed to the queue associated with the window that is identified by the coordinates of the event.

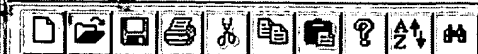
FIG. 3 illustrates the manner in which events are handled in a system according to the preferred embodiment of the invention. As in the prior art examples described with reference to FIGS. 1 and 2, Application A 10 has three windows 11, 12, 13 associated therewith and Application B 20 has one. As with the asynchronous case, every event (irrespective of the originating input device) is passed straight to a dispatcher 100, rather than being placed on a queue first. However the dispatcher 100 in this case decides whether the event has originated from a pointing device or a non-pointing device before deciding where to send the event for processing. If the event has originated from a pointing device, the positional information included in that event is used to determine which window the event was directed to, and the event is then sent to a queue that is established to receive events from pointing devices directed to that window. If on the other hand the event has come from a keyboard-like device, then the event is directed to the queue that is associated with that particular keyboard-like device. As mentioned before this queue can be transferred between the various windows as and when required; the manner in which this is done in the preferred embodiment will be discussed in more detail later.

In the FIG. 3 example, Application B is currently receiving input and the dispatcher 100 is directing input to queues 110 and 115 associated with that application. Queue 110 may, for example, be the queue permanently associated with Application B's window for the storage of events from pointing devices that are directed to that window, whilst queue 115 may be a queue for a keyboard device which is currently associated with Application B's window.

When a queue for a keyboard-like device is transferred, then in the preferred embodiment of the invention, the current queue is closed to prevent any further events from that keyboard-like device being added to it, and a new queue for that keyboard-like device is established. Depending on the situation, ownership of the closed queue may or may not be transferred to the window taking ownership of the new queue. The main thing is that, in any instance, there is only one open queue for any particular keyboard-like device, the dispatcher 100 having access to information identifying the location of such open queues.

With regards to the queues established for pointing devices, these queues are always associated with specific windows and are not transferred between windows. Hence it is not necessary to have only one such queue open at any one time (although in the preferred embodiment the system does only keep one queue open to receive input from pointing devices). Thus Application A and Application B could both simultaneously have queues open to receive input from the mouse, this being a pointing device. However they will not both simultaneously have queues open for the keyboard, since this is a non-pointing device and as such there is a single open queue associated with that device (unlike pointing devices where the open queue(s) is/are associated with specific windows rather than the device).

The closed queues can still be used by the applications with which they are associated, thereby allowing an application to process events directed to it by a particular device before the queue was closed (the queue being closed



- ☒ (10821) bar adj code adj reader) (barcode adj reader
- ☒ (2254) (input (entry adj field) (field near3 data)) same (bar adj code adj
- ☒ (717) batch adj file
- ☒ (4) (batch adj file) near5 schedul\$3
- ☒ (16) (batch adj file) same schedul\$3
- ☒ (2739) (input (entry adj field) (field near3 data)) same (bar adj code adj
- ☒ (79528) input adj device
- ☒ (10821) bar adj code adj reader) (barcode adj reader
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- ☒ (17) (((input (entry adj field) (field near3 data)) same (bar adj code adj re
- ☒ (10) (((input (entry adj field) (field near3 data)) same (bar adj code adj re
- ☒ (26) (((input (entry adj field) (field near3 data)) same (bar adj code adj r
- ☒ (536) presentation adj manager

    
  ☒ Plurals

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(((input (entry adj field) (field near3 data))
same (bar adj code adj reader) (barcode adj
reader) ) same (((input near2 (data information
barcode)) same (data near5 (object entity
message)))) (((input (entry adj field) (field
near3 data)) same (bar adj code adj reader)
(barcode adj reader) ) and ((input adj device )
same (bar adj code adj reader) (barcode adj
reader))) and ((input near2 (data information
barcode)) same (data near5 (object entity
message))))
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					Document ID	Issue Date	Page	Title	Invent
1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	US 6178426 B1	20010123	20	Apparatus with extended markup language data capture capability	Klein, John
2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	US 6119941 A	20000919	24	Automated help instructions for automatically or adaptively	Ramond, et
3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	US 5841402 A	19981124	31	configuring a hand-held device, such as a bar code reader or hand-h	Katsandres,
4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	US 5839108 A	19981117	11	Antenna means for hand-held radio devices	T. et al.
5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	US 5555459 A	19960910	32	Flash memory file system in a handheld record and playback device	Dias, Danie
6	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	US 5541398 A	19960730	13	Antenna means for hand-held data terminals	nl.
7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	US 5493106 A	19960220	18	Compact hand-held RF data terminal	Daberk, N
8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	US 5375226 A	19941220	19	Mail processing system having a barcode user interface	nl.
9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	US 5361871 A	19941108	30	Portable type data entry terminal having a keyboard input device	Hanson, Ge
10	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	US 5322991 A	19940621	13	and a graphic input device	Kraus, Robe
11	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	US 5256908 A	19931026	7	Product information system for shoppers	nl.
12	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	US 5218188 A	19930608	13	Compact hand-held RF data terminal	Gupta, Om
13	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	US 5175869 A	19921229	11	Compact hand-held RF data terminal	Hanson, Ge
14	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	US 5125091 A	19920623	11	Facility space data logging device	nl.
15	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	US 5023438 A	19910611	17	Compact hand-held RF data terminal	Averbuch, /
16	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	US 4905080 A	19900227	32	Automatic data transmission system	T. et al.
17	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	US 4897865 A	19900130	16	Object oriented control of real-time processing	Hanson, Ge
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				Automatic data transmission system	Murata, Ak
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				Object oriented control of real-time processing	Staas, Jr.,
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				Portable data input apparatus with different display modes	C. et al.
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				Apparatus for collecting television channel data and market	Wakatsuki,
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				research data	et al.
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				Telephone data collection device	Watanabe,
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					et al.
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					Canuel, Alb

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(((("5911068") or ("5485617")).PNL) and bind\$3

(9351) input near5 interrupt

(602) input adj handl\$3

(568) (((keyboard keypad) near3 input ) (input adj (device source)) (barcode adj (scanner read

(271) (((((keyboard keypad) near3 input ) (input adj (device source)) (barcode adj (scanner read

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(655) (((input adj (device source)) near4 (header parameter information field))) same (transm

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(182476) (transmit associate send) same data

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(136) (((input adj (device source)) near4 (header parameter information field))) same ((trans

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(((input adj (device source)) near4 (header parameter information field))) same ((transmit associate send) near3 (data object message)) same data

Favorites

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Queue

AKS term ICR term

	U	1	2	3	4	5	Document ID	Issue Date	Pages	Title	Current	Current X	R
1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	US 6311042 B1	20011030	11	Apparatus and methods for imaging	455/66	455/556	
2	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	US 6272477 R1	20010807	12	Hypertrapezoidal fuzzy dynamic	706/5	706/902	
3	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	US 6272332 R1	20010807	41	Information presentation system and	455/41	455/414	
4	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	US 6263276 R1	20010717	27	Communicatory navigation system	701/20	340/988	
5	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	US 6248073 R1	20010619	54	Ultrasound scan conversion with	600/44	600/443	
6	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	US 6246400 R1	20010612	21	Device for controlling remote	345/72		
7	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	US 6240444 R1	20010529	25	Internet web page sharing	709/20	709/320	
8	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	US 6219537 R1	20010417	8	Apparatus and method for an	455/40	348/460	
9	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	US 6202024 R1	20010313	27	Communicatory navigation system	701/20	701/200	
10	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	US 6198552 R1	20010306	38	Color image information processing	358/51	358/515	
11	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	US 6184454 R1	20010206	31	Apparatus and method for	84/622	84/645	
12	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	US 6171218 B1	20010109	16	Exercise apparatus	482/57	482/900	
13	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	US 6157982 A	20001205	15	System and method for remotely	711/100	709/212	
14	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	US 6157966 A	20001205	16	System and method for an ISO7816	710/8	235/375	
15	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	US 6154788 A	20001128	13	Multi-function module incorporating	710/8	710/10	
16	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	US 6151640 A	20001121	20	Control I/O module having the ability	710/11	709/236	
17	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	US 6133758 A	20001017	13	Selectable self-timed replacement	326/93	326/95	

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The screenshot shows the BRS form interface. At the top, there are buttons for 'Search', 'List', 'Browse', and 'Queue'. Below these are checkboxes for 'QBs', 'Plurals' (checked), and 'Synonyms'. A label 'Default operator' is followed by a checked checkbox and the text 'Highlight all hit terms initially'. The main display area shows a list of results for the term 'same'. The first result is 'same (sen\$4)' with a right arrow icon. The second result is 'transmit\$4 associat\$3' with a right arrow icon. At the bottom, there are two buttons: 'BRS form' and 'ISAR form'.

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1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	US 6307640 R1	20011023	8	Computer-based network printing system and method	358/1.1	358/1.15	
2	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	US 6307571 R1	20011023	23	Customizable user interface for a mailing apparatus	345/76	345/467	
3	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	US 6305009 R1	20011016	17	Compiler design using object technology with cross-platform capa	717/4	717/3	
4	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	US 6292473 R1	20010918	66	Mobile communications terminal for satellite communications system	370/31	370/328	
5	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	US 6279826 R1	20010828	80	Fault monitoring and notification system for automated banking	235/37	340/5.41	
6	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	US 6270010 R1	20010807	40	Automated transaction machine with flexible note storage member	235/37	235/380	
7	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	US 6266055 R1	20010724	25	Customizable user interface for a mailing apparatus	345/86	345/835	